Men and Women Not Created Equal in Terms of Predisposition to Musculoskeletal Problems:

First comprehensive review of disparities calls for proper diagnosis and treatment based on sex.

07/05/2005 | ROSEMONT, Ill. - The influence of sex and gender on musculoskeletal health is much stronger than previously thought, according to an article in the July 2005 issue of The Journal of Bone & Joint Surgery.

While earlier studies have shown that some chronic musculoskeletal conditions are more prevalent in females than in males, and vice versa, this is the first comprehensive review to explore the causes of these disparities. The report prompts a call to action among researchers and physicians, pushing for male- and female-specific research and data analysis to ensure that musculoskeletal ailments are properly diagnosed and treated.

A workshop convened by the American Academy of Orthopaedic Surgeons (AAOS) Women's Health Issues Committee sought to prioritize areas of research related to how sex (defined in terms of biology) affects health. AAOS members Laura L. Tosi, MD; Barbara D. Boyan, PhD; and Adele L. Boskey, PhD, organized and co-chaired the workshop which covered topics such as the cellular and molecular biology of male and female cells and tissues, the influence of chromosomes versus hormones on injury and disease, and disparities between men and women in presentation and treatment response of musculoskeletal conditions. The goals of the conference were to motivate change in the way in which musculoskeletal health research is conducted and to improve musculoskeletal care in both men and women.

Currently, the authors note, sex-specific differences are rarely considered when defining how to provide optimal care for patients with orthopaedic and other musculoskeletal conditions. The failure to consider such differences is hard to justify, given that many types of cells from females are known to behave differently than cells from males. Making distinctions concerning treatment is further complicated by the fact that not all differences between sexes can be attributed to estrogen and testosterone levels. Many are due to differential expression of the X and Y chromosomes. Bone Growth and Development Workshop participants grounded many of their discussions on some basic and indisputable differences between men and women. For example, it is well known that men tend to be taller than women. This is because boys and girls stop growing at different ages, a phenomenon that is related to sex-specific behavior of cells and genes. The fact that girls stop growing sooner than boys do also leads to differences in peak bone mass between males and females and partially explains why women are more susceptible than men are to osteoporosis.

One measure of bone strength is width. In females, bones stop gaining width by age 14, while males continue to amass bone until nearly age 20. As a result,

male bone is significantly wider than female bone. Just as it is easier to bend a drinking straw than to bend a paper towel roll, it is easier to bend, and thus break, a woman's bones. Women's bones are smaller and narrower, and therefore more apt to fracture, than men's bones.

Muscle Injuries, Puberty and Steroid Use

Another well-known fact is that men and women have different patterns of athletic injuries. These varying patterns have been attributed in part to differences in gait and motion patterns. Prior to puberty, males and females have similar jumping and landing strategies. However, the onset of puberty produces changes in sex hormones that lead to differences in muscle behavior between the sexes. Thus, as humans mature, muscle formation, use, and joint stability during sports are different for men and women. Females are more limber and use their muscles differently than men. These and other factors may explain why women suffer more anterior cruciate ligament injuries than males do. One intriguing question is whether or not women's muscles could be trained to mimic the movement of men's muscles and therefore reduce the possibility of injury. Differences between the sexes are partially modified by glucocorticoid and sex steroid treatment, and steroids drastically alter muscle growth. More research needs to be conducted in this area to determine the long-term effects of steroid use on men and women.

Pain Management

Some painful disorders are more prevalent in females than in males. "Recent research demonstrates that this is because female brains have different pain receptors and respond differently to pain than men" explained Dr. Tosi. "This has major implications on how women and men should be treated pre- and post-operatively, not only in terms of prescribing medication types and dosages but also in terms of determining the appropriate level and frequency of analgesia and rehabilitation."

Cancer

Cancer affects men and women in different ways; for example, males develop 60 percent more primary musculoskeletal tumors than females, yet females with such tumors have a nearly 15 percent better chance of survival than do males. Breast and prostate cancer both metastasize to the bone, which not only alters the bone's properties but also increases the likelihood of fracture. There are currently no sex-specific tools for measuring response to treatment of primary cancers in men and women. Physicians measure outcomes of breast cancer treatment using instruments developed for measuring outcomes for primary cancers in men. The lack of a sex-specific measurement tool could result in false predictions of the impact of the therapy on bone strength and resistance, underscoring the need to develop distinct measurements for each sex.

Change across the Age Span

The workshop underscored that data from musculoskeletal research need to be stratified by age as well as by sex. Because male and female cells respond differently to natural hormones, diseases not only present differently but also present at different stages in life in men and women. For example, the prevalence of stroke is lower in women than in men until about age 60. However, 10 years after women reach menopause, and, their estrogen levels are depleted, their risk of stroke rises and becomes similar to that of men of that age. Until recently, these data contributed to the practice of prescribing estrogen to men and women as a means of preventing cardiovascular disease. But, in the Women's Estrogen for Stroke Trial, conducted in 2003, post-menopausal women treated with estrogen not only had more strokes but also had more fatal strokes than untreated women.

Potential Impact of Cutting-Edge Procedures

Workshop data indicate that the sex, age, and hormone status of musculoskeletal tissue donors must be considered before the transplantation of bones, muscles, or tendons. Female stem cells, for example, have been more successful in treating muscular dystrophy in preclinical models than male stem cells. But in solid organ transplants, organs from male donors have a much higher success rate than those from females. This finding could have major implications on the success of bone grafts and cartilage transplants. More sex-specific research is required to determine how significant a role these factors play.

Recommended Agenda for Improving Patient Care

"According to the National Ambulatory Medical Care Survey, musculoskeletal complaints are among the top reasons Americans see a doctor. Thus, it is critical that orthopaedists – as well as other clinicians in the musculoskeletal health field – have the most accurate, sex-specific data possible available at their fingertips, said Dr. Tosi. "Knowing which sex is predisposed to certain diseases and medical conditions, and why, will enable us to more effectively treat – and eventually prevent –musculoskeletal health conditions. Expanding research on the influence of sex on musculoskeletal health will have a tremendous impact on our patients' quality of life." Dr. Tosi is the immediate past chair of the Women's Health Issues Committee of the AAOS and serves on the faculty of George Washington University School of Medicine and Health Sciences in Washington, DC, Dr. Boyan is on the faculty of the Georgia Institute of Technology and Dr. Boskey is on the faculty at the Hospital for Special Surgery in New York. The Journal of Bone & Joint Surgery (JBJS) is the official scientific publication of the 28,000-member American Academy of Orthopaedic Surgeons (www.aaos.org or http://orthoinfo.org), a not-for-profit organization that provides education programs for orthopaedic surgeons, allied health professionals, and the public.

The AAOS will celebrate its 75th Anniversary at our 2008 Annual Meeting in San Francisco. Visit (www.aaos.org/75years) and be a part of our history! The peer-reviewed JBJS, located in Needham, Massachusetts, is published monthly.

Abstracts are available online at (http://www.jbjs.org).

An orthopaedic surgeon is a physician with extensive training in the diagnosis and nonsurgical as well as surgical treatment of the musculoskeletal system including bones, joints, ligaments, tendons, and nerves.

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